Field Equipment for Food Inspectors

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THE scope of activities of the food inspection staff of the Baltimore City Health Department has been greatly extended during recent years. This was done largely by providing the inspectors with improved testing outfits. The new outfits make it possible to sample materials more efficiently and permit a variety of chemical testing during the course of inspection. In this way a considerable reduction is effected in the number of samples which otherwise would have been submitted to the Bureau of Laboratories of the department. Moreover, the removal of hazardous chemicals and spoiled food from food establishments is greatly expedited. It is the purpose of this paper to describe the methods and equipment used by food inspectors of the Baltimore City Health Department for making some analytical examinations in the field.

FIELD EQUIPMENT

Each inspector has a convenient leather case (Figures 1 and 2) which contains the usual detention cards, violation notices, copies of laws, educational forms and leaflets, sample identification cards, and such conventional equipment as flashlight, thermometer, can opener and meat trier. Paper bags and paper spoons are carried for collecting food samples; sterile 4 oz. bottles for water samples, and sampling vials for food utensil swabbing. Portable apparatus is also provided for the detection of fluorides, cyanides, cadmium, arsenic, and sulfites; equipment is included for testing the strength of chlorine solutions used as disinfectants and for the detection of spoilage of shucked oysters and crab meat. Wherever possible, testing materials are contained in uniform glass vials and each case is fitted with a wooden rack to hold the apparatus. All solutions, test papers, and other equipment are periodically replaced and reconditioned by the Bureau of Laboratories.

ANALYTICAL PROCEDURES

1. *The Detection of Spoilage of Shucked Oysters*—

The usefulness of pH measurements of oyster liquor as an adjunct to organoleptic examination in the detection of spoilage of shucked oysters has been demonstrated by several investigators.[1,2] The pH of fresh shucked oysters varies between 6.0 and 7.0. A pH value of 5.4 to 5.8 is regarded with suspicion, while values below this range are indicative of decomposition. A convenient field examination is made by transferring 5 ml. of oyster liquor to a test tube graduated at 5 ml. and adding 0.5 ml. of methyl red indicator solution (0.02 per cent methyl red in 50 per cent alcohol). After mixing, the color produced is compared with the methyl red color standards in sealed glass ampules. Standards reading pH 5.4 and 6.0 are provided. If there are indications that

FIGURE 1—Leather case containing equipment

the oysters have been recently washed, several drops of the indicator solution are placed directly on the oyster. The production of a persistent red color indicates spoilage.

2. The Detection of Spoilage of Crab Meat—

The decomposition of crab meat involves a progressive proteolysis, accompanied by a rapid rise in the ammonia

FIGURE 2

content of the meat. In 1932 Harris[3] proposed the Nessler ammonia test as a means of differentiating fresh from spoiled crab meat. The test used by our inspectors is done in this manner: About 1 gm. of crab meat is transferred to a test tube and shaken with several ml. of water, and 2 to 3 drops of Nessler's reagent are then added. The immediate development of a deep yellow or brown color indicates spoilage of the meat. The test is used only as an aid to organoleptic examination of the suspected crab meat.

3. *The Detection of Cyanide in Metal Polish*—

In 1930, Williams[4] pointed out the possible rôle of metal polish which contained cyanide in cases of gastroenteritis. In 1938 the Maryland State Department of Health adopted regulations governing the retail sale or use of cyanide containing preparations. Many other communities have similar legislation.[4]

The qualitative detection of cyanide in metal polishes in the field may be conveniently made with sodium picrate test papers.[5] This test paper is moistened with water and is then suspended in the container of the suspected polish. Care is taken that the paper does not come in contact with the material. The paper turns orange and then brick red in 5 to 10 minutes if the concentration of cyanide (as KCN) exceeds 0.5 per cent. Although the reaction is not wholly specific for cyanide, the method serves as a ready screening test in the field.

4. *Cadmium*—

Because of the difficulty in obtaining aluminum and stainless steel there has been a tendency on the part of the equipment manufacturing companies to use cadmium for plating utensils and equipment. A number of food poisoning outbreaks attributed to the consumption of acid foods stored in cadmium-plated vessels have been reported.[6] Warnings of the dangers of the use of cadmium-lined utensils have been issued to the newspapers by the Federal Security Agency.

A simple testing unit to detect cadmium during the inspection of food establishments in Baltimore was devised.[7] The outfit consists of two small vials. One contains strips of filter paper which have been impregnated with a 20 per cent sodium sulfide solution and dried; the other contains small cotton swabs immersed in 10 per cent nitric acid. The swab is rubbed on the suspected metal and is then applied to the sodium sulfide paper which has been previously moistened with water. The instantaneous appearance of a canary yellow stain on the paper indicates the presence of cadmium.

5. *Available Chlorine in Disinfectant Solutions*—

Regulations of the Maryland State Board of Health require that all food containers (drinking glasses, plates, forks, etc.) used in establishments dispensing food or drink, after cleaning and rinsing, must be disinfected either by immersing in water at 180° F. or above, or by immersion in a solution containing not less than 100 p.p.m. of available chlorine.

The strength of chlorine rinse waters is determined by a modification of the orthotolidine test.[8] Inspectors carry a 2 oz. dropping bottle of orthotolidine solution, a 100 p.p.m. permanent chlorine standard in a sealed ampule, a test tube of the same diameter as the standard and graduated at 10 ml., and a medicine dropper calibrated to deliver 20 drops of water per ml. Ten ml. of tap water are added to the tube, followed by 4 drops (0.2 ml.) of the rinse water under test, and 1 ml. of the orthotolidine solution. After 5 to 10 minutes, comparison is made with the standard.

The permanent standard actually corresponds to 2 p.p.m. of chlorine. However, the sample is diluted 1 to 50 in the test. The permanent standards are prepared by the method of Scott, which permits color matching irrespective of the tube length.[9]

Recently a compact portable iodimetric testing outfit for residual chlorine was prepared for dairy inspectors. This outfit consists of Barnes dropping vials which contain potassium iodide-starch solution, lactic acid solution, and standard sodium thiosulfate solution. The rinse water is transferred to a vial graduated at 10 ml. The standard solution is so adjusted that one drop is equivalent to 20 p.p.m. of available chlorine when 10 ml. of rinse water is titrated. This iodimetric method gives a more exact evaluation of the strength of the chlorine rinse water than does the orthotolidine test and it may be used with chloramine preparations, whereas the orthotolidine test does not function well in the presence of chloramine compounds.

6. *Fluoride-containing Insecticide Powders*—

Accidental poisoning from white sodium fluoride is not uncommon. In 1941 the Maryland State Board of Health adopted regulations requiring that insecticides containing sodium fluoride shall be colored Nile blue as a warning. These regulations were adopted because of the widespread use of insecticides containing uncolored sodium fluoride in hotel, restaurant, and hospital kitchens in Maryland.[10]

Inspectors are equipped with vials of fluoride test paper. The test depends on the fact that, in the presence of strong acids, soluble fluorides decolorize the zirconium lake of sodium alizarin sulfonate. Strips of filter paper are impregnated with the fluoride reagent[11] and are then dried. The test is made by moistening a test paper with dilute hydrochloric acid (the orthotolidine solution carried by the inspectors for the residual chlorine test may be used). The moist strip is then touched to the suspected powder and, in the presence of a large amount of soluble fluoride, decolorization of the paper will occur in about 5 seconds. Decolorization is evident in about 30 seconds when a 1 to 1,000 dilution of sodium fluoride powder in flour is used. A reaction time of 5 minutes should be allowed for traces of fluoride. Phosphates and oxalates may yield false tests and therefore positive findings should be confirmed in the laboratory.

7. *Detection of Sulfites in Meat Products*—

Sulfites in ground meat serve partly as a preservative but are employed chiefly to deodorize and to restore the bright red color of fresh meat.[12] The A.O.A.C. qualitative test for sulfurous acid[13] was adapted as a field test. The method for sulfite detection depends upon the evolution of hydrogen sulfide when material containing sulfite is treated with zinc and dilute mineral acid. The evolved hydrogen sulfide blackens a cotton dental roll moistened with lead acetate and contained in a Gutzeit scrubber tube.[14] The essential features of the test are indicated in Figure 3.

To make the test about 10 gm. of ground meat are transferred to a wide mouth bottle containing 30 ml. of 10 per cent sulfuric acid. The bottle is stoppered and shaken moderately for 10 seconds. Several minutes are allowed for foam to subside. Three grams of 30 mesh granulated zinc (arsenic and sulfur free) are added. A stopper containing a Gutzeit scrubber tube[14] previously fitted with a No. 2 cotton dental roll impregnated with 20 per cent lead acetate solution is immediately inserted. The cotton roll will become black in 5 to 10 minutes and after about 10 min-

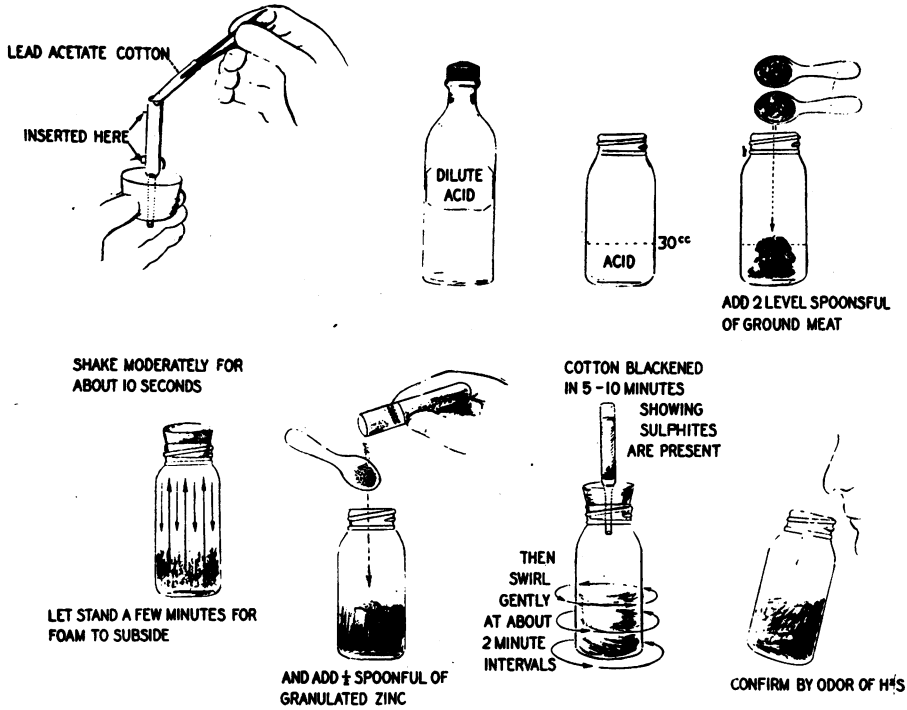

FIGURE 3

utes the bottle may be opened, when there will be a decided odor of hydrogen sulfide if sulfites are present. The test will detect as little as one grain of sodium sulfite in a pound of ground meat. Traces of sulfides in foods may yield false positive tests, and because of this the outfits are intended for screening tests only. All samples which show positive reactions are submitted to the laboratory for confirmatory analyses.

8. *Arsenic Spray Residue*—

The presence of excessive amounts of arsenic spray residue on fruits and vegetables is suspected when there are unusual deposits on the foods. In order to eliminate the detention of truck, boat, or railroad shipments pending laboratory examination, testing for arsenic is done in the field. The test used is an adaptation of the official Gutzeit method for arsenic of the A.O.A.C.[14] Similar modifications have been used by others.[15]

The equipment designed for the sulfite determination in ground meat is also used for the arsenic tests. A piece of glass tubing is fitted to the Gutzeit scrubber tube to hold a strip of sensitized mercuric bromide paper. In addition, 15 ml. of 40 per cent stannous chloride solution is added to each liter of the 10 per cent sulfuric acid reagent. In practice the acid used for the sulfite test contains the stannous chloride addition and is thus also suitable for the arsenic examination. The details of the tests are indicated in Figure 4. The directions are essentially the same as in the case of the sulfite examination. Scrapings of suspected material are introduced into the generator. The acid and zinc are added and the reaction is allowed to proceed for 30 minutes. A decided yellow to dark brown colora-

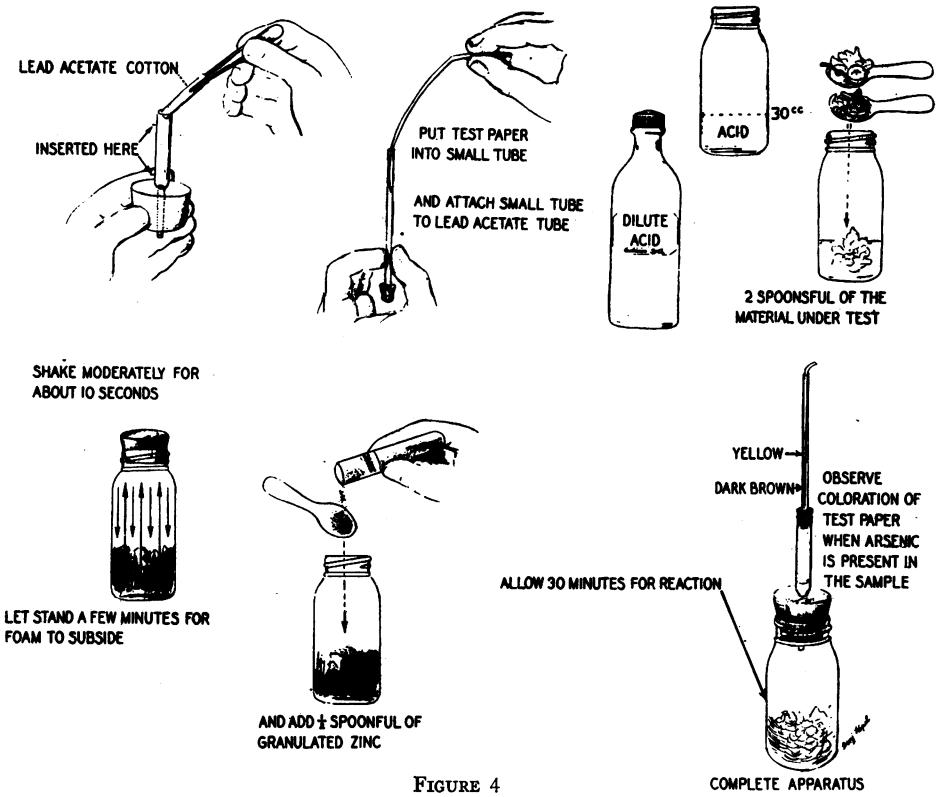

FIGURE 4

tion of the sensitized mercuric bromide paper indicates the presence of arsenic.

9. *Food Utensil Swabbing*—

The improved vials recently described by Buck[16] are routinely used by the Baltimore City Health Department food inspectors to secure bacteriologic samples from drinking glasses and food utensils. The vials have a plastic screw type closure which holds a wooden applicator with cotton attached. Salt solution or broth is sterilized directly in the vials. It is possible for the inspector to carry a number of these small vials in his carrying case without fear of contaminating them.

10. *Other Tests*—

Other equipment may be added to the inspector's carrying case as needs arise, as for example, the Scharer modification of the phosphatase test for the detection of proper pasteurization of milk and cream[17] which is adapted to field use. Soft drink bottling plant inspectors may use an outfit for testing the alkalinity of wash waters. The foam test[18] for renovated butter and oleomargarine may be carried out in the field by means of a spoon and an alcohol lamp.

DISCUSSION

More than 6,000 field tests have been made by the staff of the Bureau of Food Control of the Baltimore City Health Department during the past two years. The majority of these tests were examinations of chlorine rinse waters and food utensil swabbings. Other tests revealed that metal polish containing cyanide was in use in more than 200 food establishments, which led to regulations prohibiting its use. Field testing resulted in the condemnation of at least

50 lots of incipiently decomposed shucked oysters which could not have been readily detected by organoleptic means. Sulfite in ground meat is now rarely encountered, largely because meat dealers know that the Health Department has ready means of its detection.

The field test is never used as a basis for prosecution. The purpose and the intention of the field tests is to assist the inspectors' organoleptic senses and is not meant to supplant the more critical examination of foods by trained chemists. Inspectors are cautioned to use the field methods for information and screening purposes only and to submit samples to the Bureau of Laboratories for confirmatory analyses.

SUMMARY

A description has been given of the methods and equipment used by food inspectors of the Baltimore City Health Department for making selected analytical examinations in the course of inspections of food establishments.

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